Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

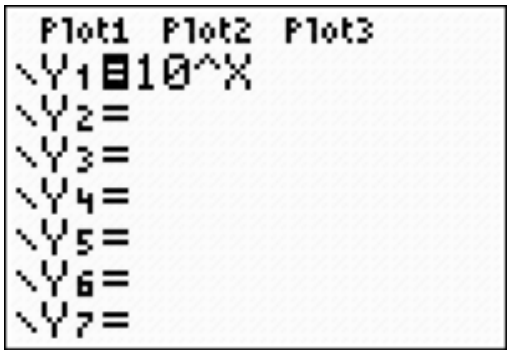
Warm-up

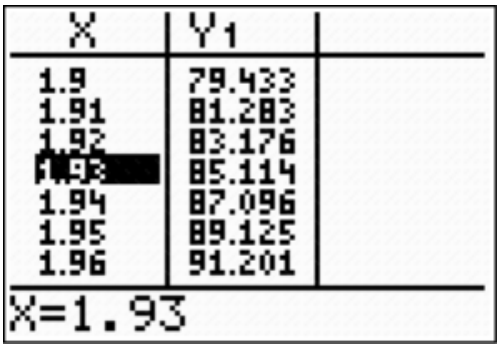
In the learn-on-your-own on Friday, you were asked to approximate the solution to $10^x = 85$ (to the nearest 100th) using your table feature on your calculator.

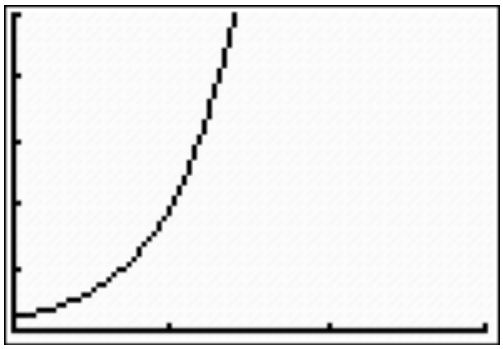
Enter the answer you got into your clicker now!

Need help?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.







Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Exponential Form

$10^x = 1000$

base exponent

We are used to solving exponential equations like these.

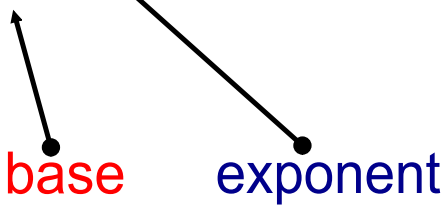
Find x:

2) $10^x = \frac{1}{10000}$

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Exponential Form

$10^x = 7$

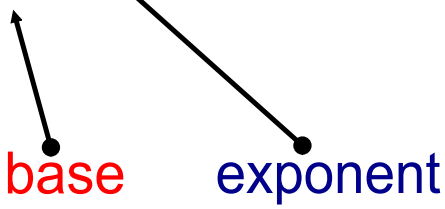


This one is not so easy.
Why not?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Exponential Form

$10^x = 2.3$



In order to solve equations like the one to the left, we need

LOGARITHMS.

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

LOGA -WHAT?

Logarithms UNDO *Exponentials*

Logarithmic functions define:

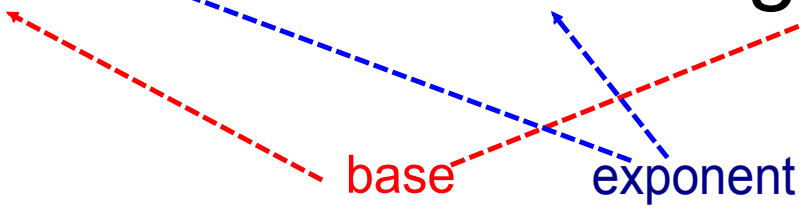
- Magnitudes of earthquakes
- Loudness of sound
- pH measurements
- Limits of telescope magnitude

A *Logarithm* IS an *Exponent*

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Exponential Form $10^3 = 1000$

Logarithmic Form $3 = \log_{10} 1000$



A log is an exponent.
The base stays the base.

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Equivalent Exponential and Logarithmic Forms

For any positive base b, where $b \neq 1$:

$b^x = y$ if and only if $x = \log_b y$

http://www.purplemath.com/modules/logs.htm

Scroll down to the animated relationship

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Write $5^3 = 125$ in logarithmic form

a) $5 = \log_3 125$
b) $3 = \log_{125} 5$
c) $5 = \log_{125} 3$
d) $3 = \log_5 125$
e) None of these

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Write $\log_3 81$ in exponential form

a) $4^3 = 81$
b) $3^4 = 81$
c) $81^3 = 4$
d) $4^{81} = 3$
e) None of these

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Rewrite each in the opposite form

$\log_2 32 = 5$

$8^3 = 512$

$\log_3 \frac{1}{81} = -4$

$3^{-2} = \frac{1}{9}$

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Locate your LOG key on your calculator.

You can evaluate logarithms
with a base of 10
by using the **LOG** key
on your calculator.

Find $\log_{10} 73$
round to the nearest 100th.

LOG base 10 is called the "common log".

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

$\log_{10}73$
can also be written as log73...

However

the base can be left off if and only if it is base 10.

LOG base 10 is called the "common log".

Why?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Solving an exponential equation

Solve $10^x = 85$ for x.

Any ideas?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Solving an exponential equation

Solve $10^x = 85$ for x.

Write in LOGARITHMIC FORM

$x = \log_{10} 85$

Use your LOG key on your calculator!

Does the answer make sense?
Why or why not?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Examine the two tables below:

x	$y = 10^x$
-3	$\frac{1}{1000}$
-2	$\frac{1}{100}$
-1	$\frac{1}{10}$
0	1
1	10
2	100
3	1000

x	$y = \log_{10} x$
$\frac{1}{1000}$	-3
$\frac{1}{100}$	-2
$\frac{1}{10}$	-1
1	0
10	1
100	2
1000	3

What do you notice?

What type of relationship exists?

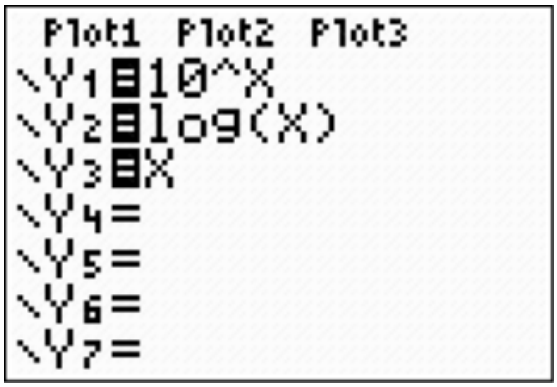
How will their graphs compare?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

x	$y = 10^x$
-3	$\frac{1}{1000}$
-2	$\frac{1}{100}$
-1	$\frac{1}{10}$
0	1
1	10
2	100
3	1000

x	$y = \log_{10} x$
$\frac{1}{1000}$	-3
$\frac{1}{100}$	-2
$\frac{1}{10}$	-1
1	0
10	1
100	2
1000	3

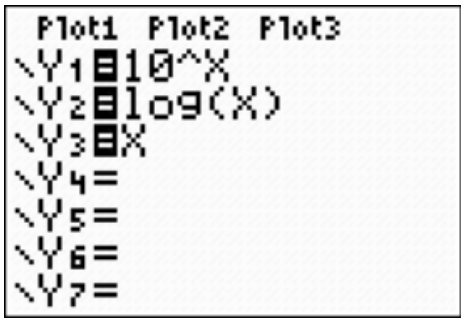
Graph the following:

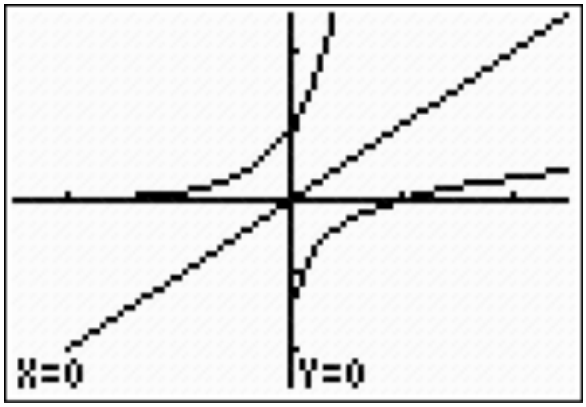


Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

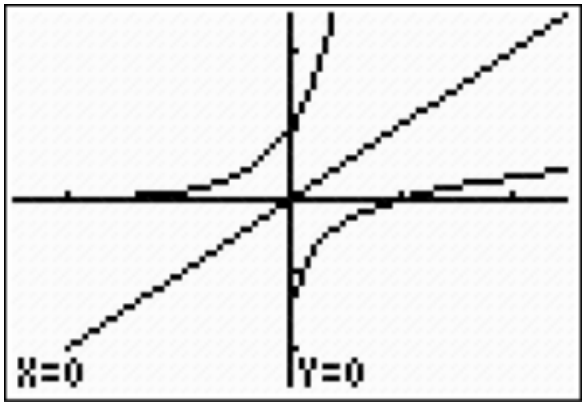
x	$y = 10^x$
-3	$\frac{1}{1000}$
-2	$\frac{1}{100}$
-1	$\frac{1}{10}$
0	1
1	10
2	100
3	1000

x	$y = \log_{10} x$
$\frac{1}{1000}$	-3
$\frac{1}{100}$	-2
$\frac{1}{10}$	-1
1	0
10	1
100	2
1000	3





Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.



What is the domain of $y = 10^x$?

What is the domain of $y = \log_{10} x$?

What is the range of $y = 10^x$?

What is the range of $y = \log_{10} x$?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

One-to-One Property of Exponents

if $b^x = b^y$

then $x = y$

How do we use this to solve

$y = \log_{125} 5$?

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

$$y = \log_{125} 5$$

$$125^y = 5$$

$$(5^3)^y = 5$$

$$5^{3y} = 5^1$$

using one-to-one property...

$$3y = 1$$

$$y = 1/3$$

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Try these!

$r = \log_2 1$

$\log_y 9 = 1/2$

$2 = \log_6 v$

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

Chemistry Connection

The pH of a sample of sea water is 8.3. What is the level of $[H^+]$ (hydrogen ion in moles/liter)?

Given: $pH = -\log_{10}[H^+]$

Solution

Objective: Students will write equivalent forms for *exponential* and *logarithmic* equations and use them to solve equations.

!HOMEWORK!

Page 374 (12 - 100) by 4's